

Central Bank Seigniorage: Czech Republic 1993-1997*

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In this paper the concept of total gross seigniorage is used to analyze sources and uses of central bank seigniorage revenues in the Czech Republic during the period 1993-1997. A comprehensive framework for measuring total gross seigniorage and its main components is presented and estimates of seigniorage revenues (sources and uses) are computed and analyzed. The study shows that the conventional concept of monetary seigniorage should not be used as an estimate of government gains from money creation. Moreover, the analysis of the scope of budget deficit financing through money printing in the considered period in the Czech Republic presented in the paper shows that revenue from the creation of money has never been extensively used as a tool for financing government expenditures.

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1. Introduction

The initial stage of reforms in Central and Eastern European economies was accompanied by a sharp decline in economic activity, an increase in inflation rates and significant fiscal problems. Large budget deficits resulted from a big drop in the tax base, associated with a drop in real output which was unmatched by fiscal expenditure cuts. In most Central and Eastern European countries large public sector deficits determined monetary growth, inflation rates and seigniorage revenues in the beginning of the transition period.

A number of authors consider seigniorage revenues as an important source of government finance (see, e.g., Drazen, 1989; Bruni, Penati and Porta, 1989, Grilli, 1989, and Gross, 1993). Recent research shows that the seigniorage in several Southern European countries as a share of GDP varies between 2 and 4 percent (Horrendorf, 1997). The importance of seigniorage as a revenue instrument in Central and Eastern European countries has been also frequently analyzed (see, for example, Oblath and Valentinyi, 1994; Kotulan, 1995; Hochreiter, Rovelli and Winckler, 1996; Budina, 1997; and Cukrowski and Janecki, 1998). The results indicate that the experiences in collecting seigniorage revenue differ across countries. Hochreiter, Rovelli and Winckler (1996), for example, study central bank seigniorage in five countries: Romania, Hungary, Czech Republic, Austria and Germany. Their findings (base on opportunity cost and inflation tax definitions of seigniorage)¹ indicate that central bank seigniorage in 1993 was about 30% of GDP in Romania (due to the high inflation rate), and 4% of GDP in Hungary (due to the high ratio of central bank assets to GDP in Hungary). Seigniorage in the Czech Republic was around 1% of GDP (similar to that of Austria and Germany). This

¹ See Section 2.

could suggest that revenues from the creation of money play very different budgetary roles in Eastern European countries. However, as indicated by Klein and Neumann (1990) and Neumann (1996), to properly compare seigniorage revenues in various countries one has to take into account a number of country-specific features, requiring a more detailed analysis of the mechanism underlying the seigniorage revenue creation process.

This paper focuses exclusively on Czech National Bank seigniorage revenues in the period 1993-1997. Following Neumann (1996), we define seigniorage in the broadest possible sense as the sum of all revenues resulting from the monopoly power to issue money. Unlike existing empirical studies we take into account the important fact that seigniorage depends also on legal, institutional and operational details that are relevant for the creation of base money in a country (see Klein and Neumann, 1990; and Neumann, 1996). This approach not only allows proper estimation of the seigniorage revenues in subsequent years, but also shows how the size of seigniorage revenues should be computed for the purpose of inter-country comparisons.

The paper is organized as follows. In the next section we discuss some issues related to the economic understanding of the term 'seigniorage'; moreover, we present alternative definitions, and the concept of total gross seigniorage and the sources of total gross seigniorage. In the third section we consider the uses of total gross seigniorage. In the fourth section we show the measurement framework, describe the data sources and present empirical results. In the fifth section we discuss the results computed. Finally, the last section contains the main conclusions.

2. The Concept of Seigniorage

The concept of seigniorage can be defined in a few different ways. In the classical theoretical literature (see e.g., Drazen, 1985) three basic definitions of seigniorage are used. The first defines seigniorage as *inflation tax* (ph , where p is the inflation rate and h denotes real high-powered money). The second defines seigniorage as *opportunity cost of holding money* (ih , where i is nominal interest rate) – the private sector's loss of foregone interest revenue from holding non-interest bearing cash balances instead of earning assets. The third – and the most general – defines seigniorage as *total revenues associated with money creation* ($mh + (r-n)a$, where m is the nominal growth rate of high-powered money; $r-n$ is the difference between the real rate of interest and the population growth rate; a is the real stock of interest earning government assets, $a < h$). It has been shown (see Drazen, 1985) that the first two definitions are special cases of the last one.

As with most conceptual issues, there is no clear indication which definition of seigniorage is the best. In the analysis which follows we adopt the concept of gross seigniorage, proposed by Klein and Neumann, (1990) and Neumann (1996), which encompasses all other concepts.² In particular, we define *total gross seigniorage* as the real gross resource flow to the government sector associated with base money creation (Neumann, 1996). Formally, we specify total gross seigniorage s as

$$s = s^M + \frac{i^P A^P + i^F A^F}{p} + \frac{G}{p}, \quad (1)$$

where

² See Neumann (1996) for a detailed explanation of how the concept of total gross seigniorage fits the definition (3) presented above.

s^M is monetary seigniorage defined as a change in base money stock M deflated by the general price level p :

$$s^M = \frac{\dot{M}}{p} = \frac{\dot{M}}{M} m \quad (2)$$

(m denotes real balances);

A^P and A^F denote a private sector debt and foreign debt, respectively;

i^P and i^F stand for corresponding nominal interest rates;

G denotes revenue from central bank's operations.

Monetary seigniorage s^M measures the actual wealth transfer which the private sector has to make in order to receive base money in the amount of M from the central bank. The second term in expression (1) describes the flow of interest revenue on the stock of non-government debt that the central bank bought in the past in exchange for non-interest bearing base money (the debt service on the central bank's stock of government debt is not included here because it is merely an inside transaction between the government and the central bank). The third term in expression (1) describes seigniorage revenue from central bank's operations.

3. The Distribution of Total Seigniorage

Most empirical literature presents a proxy for actual seigniorage flow to the government based on two implicit assumptions: (1) the government receives the seigniorage revenues regardless of the legal and institutional regulations governing the relationship between the government and central bank; (2) the amount of seigniorage revenue transferred to the government does not depend on the specific ways and means in which the creation of seigniorage is induced by the central bank. This is a simplification which does not take into account the cost of money production and the

existence of the central bank in general. Note that the cost of the central bank could be significant (e.g., Klein and Neumann (1990) show that in the period 1974-1987, about 16.9% of German monetary seigniorage was used to cover the Bundesbank's operating costs).

A more precise analysis presented by Neumann (1996) shows that total seigniorage is used for covering the cost of money production and central bank operation s^C , for net investment in non-government debt by the central bank s^{NI} , for replacement investment to make up for the exchange rate induced loss of assets (in terms of domestic currency)³ s^{RI} , for budget finance s^G , and for the increase of the central bank capital (or is transferred to the third parties) s^O . Thus,

$$s = s^C + s^{NI} + s^{RI} + s^G + s^O, \quad (3)$$

where

$$s^C = \frac{C^{Coin} + C^{CB}}{p}, \quad (4)$$

C^{Coin} denotes the cost of coinage, and C^{CB} stands for the central bank's cost of printing notes and maintaining operations;

$$s^{NI} = \frac{\dot{A}^P + \dot{A}^F}{p}, \quad (5)$$

A^P and A^F denote private sector debt and foreign debt, respectively;

$$s^{RI} = \frac{L}{p} = -\frac{\dot{e} A^F}{ep}, \quad (6)$$

L denotes a book loss (defined as a positive number), and e is an exchange rate;

³ In the case of a fixed exchange rate regime, s^{RI} equals zero (see Neumann, 1996; for details).

$$s^G = \frac{\dot{A}^G + (R^G - i^G A^G)}{p}, \quad (7)$$

A^G denotes government debt and R^G appropriated profit;

$$s^O = \frac{R^O}{p}, \quad (8)$$

R^O denotes profit transferred to the third parties or used for capital accumulation.

Part of the seigniorage transferred to the central government budget s^G (specified by expression (7)) is called *fiscal seigniorage* (see Klein and Neumann, 1990; and Neumann, 1996). In general, there should be two additional terms in the numerator of the expression (7): R^{Coin} – revenue from coinage (in the case where the government has rights to issue coins as in Germany, for example); and T^B – taxes on central bank's property and income (when the central bank has to pay taxes on property and income as, for instance, in Japan). In the case of the Czech Republic the government receives fiscal seigniorage through two channels: (1) net borrowing from the central bank (\dot{A}^G), and (2) appropriation of the central bank's profit, net of interest payments on the central bank's stock of government debt ($R^G - i^G A^G$). Thus, fiscal seigniorage is fully determined by expression (7).

4. Empirical Analysis

The empirical analysis of sources and uses of seigniorage revenues presented in this section is based on data from the central bank balance sheets and its statements of income and expenditures and profit distribution (the main data sources are the *Annual*

Reports of Czech National Bank).⁴ The sample period is 1993-1997. All the data are reported annually and denoted in the analysis which follows by subscript t . The Appendix explains in detail how specific entries in the balance sheets and income statements are used to obtain the data required to compute the components of total gross seigniorage and its uses.

We begin with the distribution of the total gross seigniorage. The total seigniorage s_t is the sum of the following sources:

$$s_t = s_t^M + s_t^I + s_t^A, \quad (9)$$

where the monetary seigniorage s_t^M is computed as

$$s_t^M = \frac{M_t}{P_t}; \quad (10)$$

seigniorage revenue from the stock of interest-earning foreign and domestic private assets s_t^I is determined as

$$s_t^I = \frac{IR_t - IE_t}{P_t}, \quad (11)$$

where IR_t and IE_t correspond to interest revenues and interest expenditures, respectively;

and seigniorage revenue from central bank's operations s_t^A is computed as

$$s_t^A = \frac{RE_t - IR_t}{P_t}, \quad (12)$$

where RE_t denotes the total revenue of the central bank.

The total seigniorage s_t is allocated to the following uses:

$$s_t = s_t^C + s_t^{NI} + s_t^{RI} + s_t^G + s_t^O, \quad (13)$$

⁴ The form of the balance sheet of Czech National Bank and its statements of income and expenditures and profit distribution are presented in Appendix.

where

$$s_t^C = \frac{C_t^{Co\&Bn} + C_t^{CB}}{P_t}, \quad (14)$$

C^{CB} - costs of maintaining operations of central bank,

$C^{Co\&Bn}$ - costs of coinage and printing banknotes,

$$s_t^G = \frac{A_t^G + (R_t^G - i_t^G A_t^G)}{P_t}, \quad (15)$$

$$s_t^{RI} = \frac{L_t}{P_t} = -e \frac{A_{t-1}^F}{e_{t-1} P_t}, \quad (16)$$

$$s_t^O = \frac{A_t^G - (R_t^G - i_t^G A_t^G)}{P_t}, \quad (17)$$

where P_t denotes the total profit of the central bank in the period considered.

Investment seigniorage can be computed as a residual, i.e.,

$$s_t^{NI} = s_t - (s_t^C + s_t^{RI} + s_t^G + s_t^O). \quad (18)$$

The data required for the computation of all sources and uses of total gross seigniorage in the period 1993-1997 are presented in Table A.3.

In Table 1, the sources and uses of seigniorage for the overall sample period 1993-1997 are presented in Czech Crowns. All flows are expressed in 1993 prices.

The year by year developments of the total gross seigniorage and its sources as a fraction of GDP are presented in Figure 1. The distribution of the total gross seigniorage in subsequent years as a fraction of GDP is presented in Figure 2.

Table 1. Sources and Uses of Seigniorage in the Czech Republic
(1993 prices)

		1993	1994	1995	1996	1997
Billion of Czech Crowns						
Total	s_t^T	22,82	49,92	47,14	44,84	28,90
Sources						
Monetary	s_t^M	16,70	40,12	35,53	45,76	-4,33
Interest Revenues	s_t^I	7,90	7,92	7,06	2,82	4,84
Revenues from CB operations	s_t^A	-1,79	1,87	4,55	-3,74	28,39
Uses						
Costs	s_t^C	2,57	1,95	1,66	2,17	5,72
Net Investment	s_t^{NI}		79,45	58,70	43,65	18,26
Replacement	s_t^{RI}		-0,08	-2,23	3,07	-1,42
Fiscal	s_t^F		-31,41	-10,99	-4,05	6,33
Percent of total						
Sources						
Monetary	s_t^M	73,2%	80,4%	75,4%	102,1%	-15,0%
Interest Revenues	s_t^I	34,6%	15,9%	15,0%	6,3%	16,7%
Revenues from CB operations	s_t^A	-7,8%	3,8%	9,7%	-8,3%	98,2%
Uses						
Costs	s_t^C	11,3%	3,9%	3,5%	4,9%	19,8%
Net Investment	s_t^{NI}		159,2%	124,5%	97,3%	63,2%
Replacement	s_t^{RI}		-0,2%	-4,7%	6,8%	-4,9%
Fiscal	s_t^F		-62,9%	-23,3%	-9,0%	21,9%

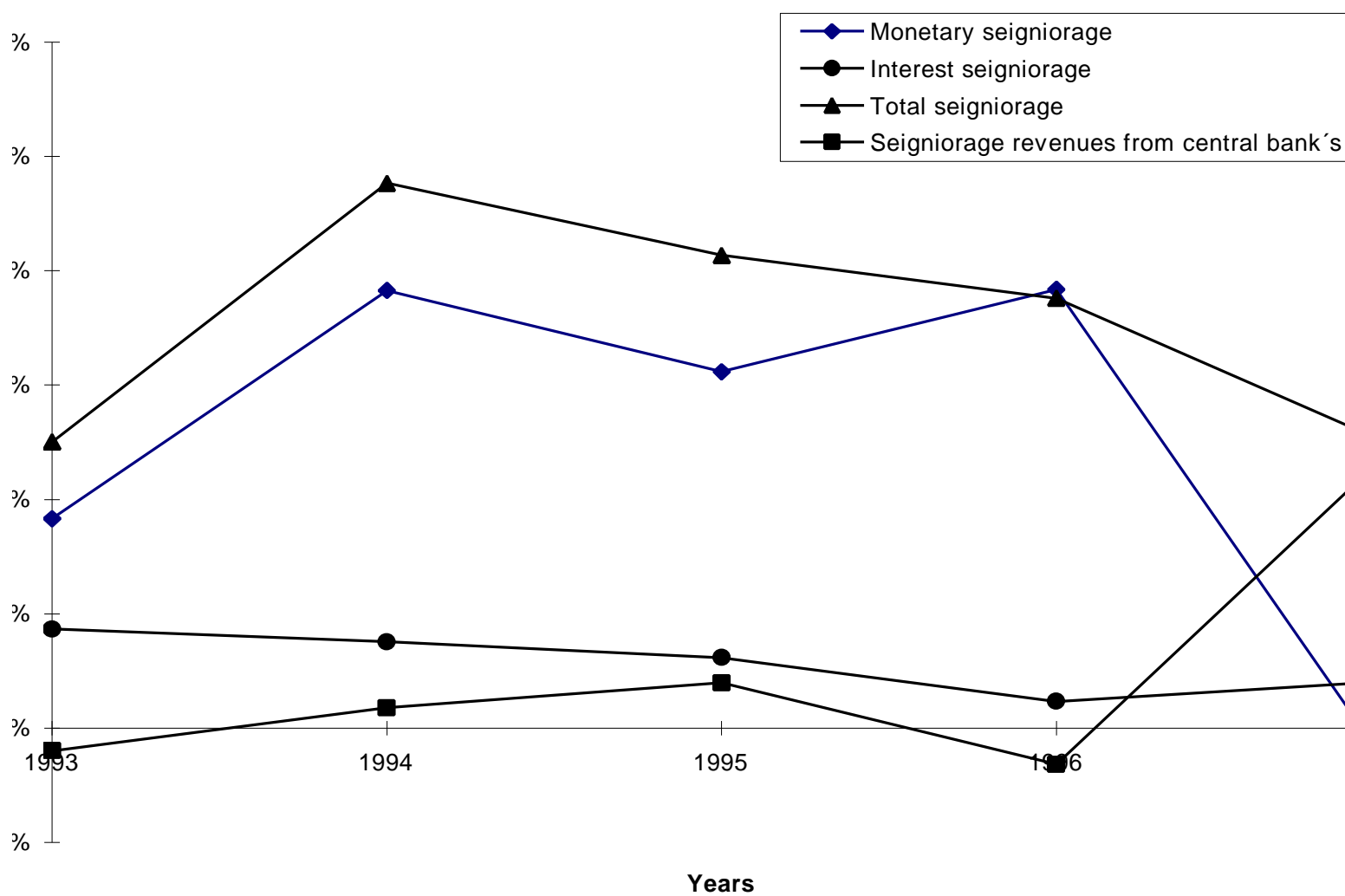


Figure 1. Total gross seigniorage and its sources in the period 1993-1997 (as a percentage of GDP)

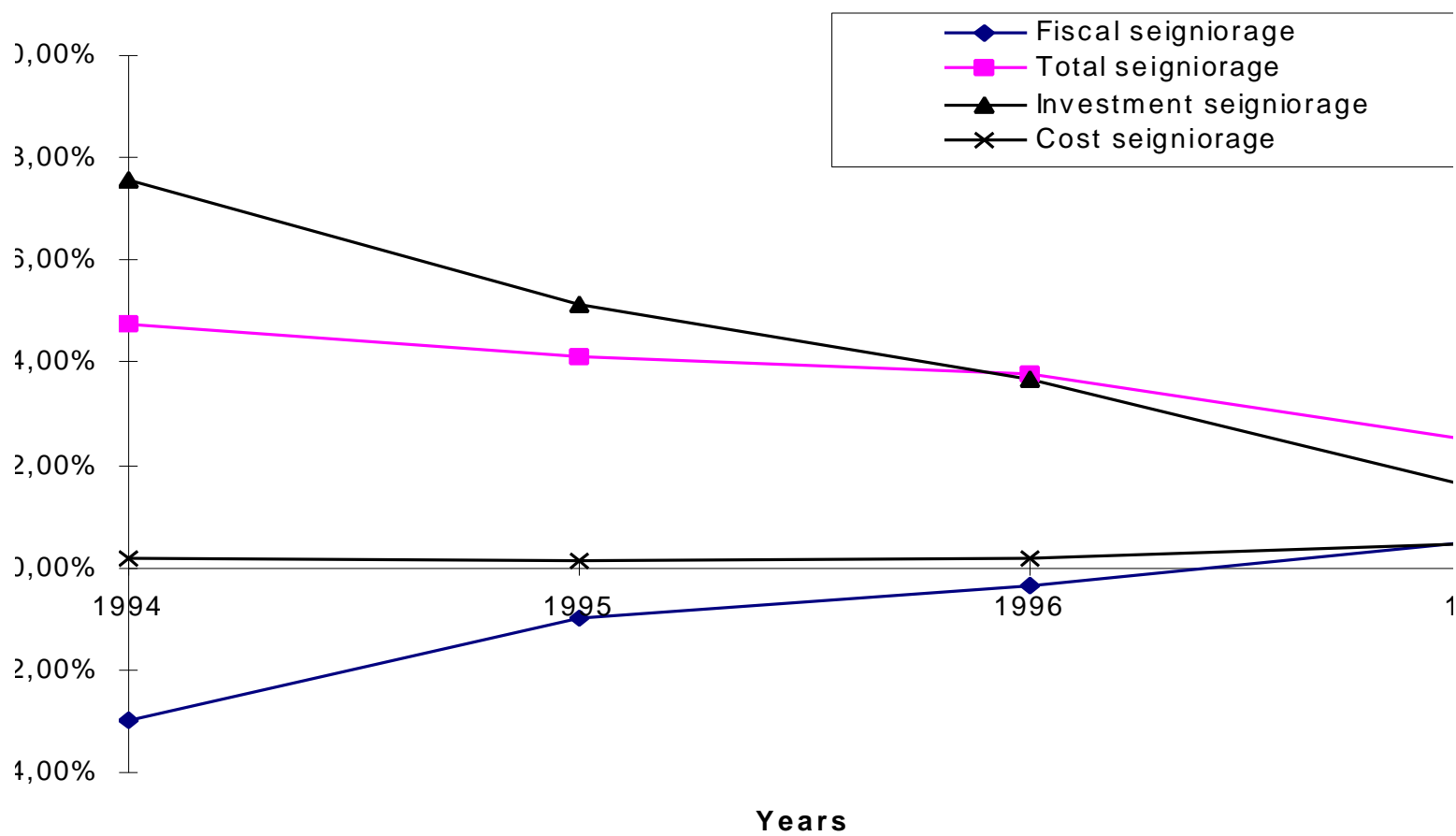


Figure.2. Total gross seigniorage and its uses in the period 1994-1997 (as a percentage of GDP)

A comparison of the conventional concept of monetary seigniorage with total gross seigniorage and fiscal seigniorage shows that monetary seigniorage usually understates total gains from money creation. Moreover, in general, it does not reflect the scope of budget deficit financing through seigniorage revenues. Furthermore, contrary to the common view that in most of Eastern and Central European countries, revenues from money creation play a significant budgetary role, the figure shows that in the Czech Republic, revenues from the creation of money have never been extensively used as a tool for financing government expenditures.

5. Macroeconomic note

In the beginning of the nineties, Czechoslovakia and later the Czech Republic implemented a successful macroeconomic program. The authorities managed to keep inflation relatively low (immediately after the transformation towards a market economy, in 1991, Czechoslovakia experienced around 57 percent inflation, which was reduced to 20 percent in 1993 and kept down below 10 percent in the years thereafter). Budget deficits in the period 1993-1997 did not exceed 1% (actually till 1995 the government budget was in surplus — in 1993 the budget surplus was about 0.1%, in 1994 about 0.9% and in 1995 about 0.5%; for 1996 and 1997, the budget deficit was –0.1% and –1% percent respectively) so there was no great pressure to use seigniorage revenues for fiscal purposes. Moreover, in the considered period the government had significant revenues from privatization. As the result, as shown in Figure 2, in the years 1994-1996 seigniorage was not used for government purposes (resources flowed from the government to the central bank). In this period most of the seigniorage revenues were used for the investment in non-government debt. Note, however, that the value of the

investment in non-government debt has been continuously decreasing starting from 7.7% of GDP in 1994 to 1.7% in 1997.

In 1997, as the result of economic disturbances, a change in the previously observed pattern of fiscal seigniorage development occurred (this change is in line with the development of the budget deficit of the Czech Republic)⁵. We should note, however, that in 1997 fiscal seigniorage was still much below 1% of GDP. It is worth mentioning that an increase in fiscal seigniorage has been accompanied by a significant decrease in the monetary base (strong monetary restrictions have been imposed in response to the high current account deficit)⁶ with a relatively small decline in the total gross seigniorage. This shows explicitly that a decrease in the monetary base does not automatically imply smaller seigniorage revenues for budget deficit financing.

The increase in the scope of the budget deficit financing accompanied by a decrease in monetary base can be explained by the activities of the Czech National Bank during the period of exchange market disturbances and the change of the exchange rate regime (the first part of 1997). For 1997, Figure 1 and 2 show huge revenues from central bank operations and more or less the same level of the central bank operation costs as in the previous years. This suggests that in 1997 the CNB accumulated foreign assets before devaluation and sold them just after devaluation with a big profit (the net investment in non-government assets was still positive but rather modest). A large profit from financial operations allowed the CNB to reduce the monetary base and at the same time to increase the flow of resources to the budget, i.e., fiscal seigniorage (see Figure 2).

⁵ In 1997 the balanced observed in previous years budget was replaced by relatively high budget deficit.

⁶ Current account deficit in 1997 was about 7.9%

To summarize the analysis above, one can say that an increase in the scope of budget deficit financing can be achieved not only by an increase in the monetary base (as it is suggested by the traditional approach to seigniorage) which could raise inflation, but also by increasing central bank efficiency.

6. Concluding Remarks

This paper has presented and applied new insights from seigniorage literature to the problem of financing the budget deficit in the Czech Republic through seigniorage revenues. In particular, contrary to other empirical studies, we have not relied on the simple concept of monetary seigniorage which measures the flow of the additional monetary base the government can issue, but instead we have used (1) a new concept of *total gross seigniorage* which measures the total flow to the government sector and (2) *fiscal seigniorage* which measures the portion of seigniorage received for budget financing.

Our empirical analysis of sources of seigniorage revenues in the Czech Republic for the period 1993-1997 has revealed that the monetary authorities' interest earnings on non-government debt (*interest revenues*) and revenues from the central bank's operations are important components of total seigniorage revenues, and therefore, the conventional concept of monetary seigniorage does not always adequately measure the total flow of seigniorage. In particular, the results show that an estimation of the total seigniorage by monetary seigniorage usually understates the total flow of seigniorage revenues. At the same time, the results indicate that monetary seigniorage should not be used as a proxy for the total flow to the government sector since it reflects fiscal seigniorage only if investment seigniorage is close to zero, something that is usually not the case in transition economies.

Moreover, in contrast to the common belief that in most transition economies revenues from money creation play a significant budgetary role, we found that in the Czech Republic revenues from the creation of money have never been extensively used as a tool for financing government expenditures. The average flow of seigniorage revenues into the budget is of a similar scope as is usually the case in developed Western European countries.

Finally, it is important to stress that the results presented in this paper imply a weakening of the link between inflation and seigniorage. In particular, much like Klein and Neumann (1990), we would like to emphasize that the increase in a monetary base (and a country's inflation rate) does not automatically imply higher fiscal seigniorage revenues. Nor does the inverse necessarily hold, i.e., a decrease in a monetary base (associated with a decrease in the rate of inflation) does not automatically imply smaller seigniorage revenues for budget deficit financing. An increase in the scope of budget deficit financing can be achieved by increasing the central bank's efficiency instead of by raising the rate of inflation.⁷ However, an analysis of the efficiency of the legal arrangements and operational procedures of the Czech National Bank has been left for further research.

⁷ Klein and Neumann (1994) show that a central bank with a sufficient extent of operational independence might be able to influence the amount of seigniorage acquired by the government even at unchanged rates of money growth.

Appendix. Data Sources

The main sources of data used for the calculations of the total gross seigniorage and its components are: (1) the Balance Sheet of the Czech National Bank and (2) the Profit and Loss Statement of the Czech National Bank. The simplified forms of these two documents (for 1997) are presented in *Table A1* and *Table A2* below. A short description follows of how *Table A3* (containing all the data used for the computation of the total gross seigniorage and its components) is constructed.

Table A1.

Balance Sheet of the Czech National Bank
as of December 1997 (in billions of Czech Crowns)

Assets			Liabilities		
<i>A.1</i>	International Reserves	89.277	<i>L.1</i>	Monetary Base	344.264
<i>A.1.1</i>	Gold	3.922	<i>L.1.1</i>	Currency in circulation	139.146
<i>A.1.2</i>	IMF Quota	24.962	<i>L.1.2</i>	Bank Deposits	205.118
<i>A.1.3</i>	Deposits at Foreign Monetary Institutions	60.393	<i>L.2</i>	Foreign Deposits	49.075
<i>A.2</i>	Loans	181.278	<i>L.3</i>	Deposits of Customers	40.828
<i>A.2.1</i>	Loans abroad*	86.278	<i>L.4</i>	Government Deposits	26.038
<i>A.2.2</i>	Loans to Domestic Monetary Institutions	76.021	<i>L.5</i>	CNB bonds	150.00
<i>A.2.3</i>	Loans to Customers	18.979	<i>L.6</i>	Capital	1.40
<i>A.3</i>	Securities	363.792	<i>L.7</i>	Other Liabilities	30.660
<i>A.4</i>	Other Assets	18.663	<i>L.8</i>	Net Income, 1997	10.745
	Total	653.01		Total	653.01

*Loans abroad include financial papers in foreign currency and deposits in foreign currency.

Table A2.

Profit and Loss Statement of the Czech National Bank
as of December 1997 (in billions of Czech Crowns)

	Revenues			Expenditures	
<i>R.1</i>	Interest Revenue	40.909	<i>E.1</i>	Interest Expenditures	34.065
<i>R.2</i>	Profit from Financial Operations*	39.611	<i>E.2</i>	Maintaining operations, printing banknotes and making coins**	5.767
<i>R.3</i>	Revenue from fees and taxes	0.552	<i>E.2.1</i>	Expenditures for printing money and minting coins	0.366
			<i>E.2.2</i>	Maintaining operations	5.401
			<i>E.3</i>	Creating Reserves for Deposits***	20.864
<i>R.4</i>	Profit for the Accounting Period	10.745	<i>E.4</i>	Creating Other Reserves	8.626

* Profit from trading all kind of financial papers (treasury bills, bonds etc.).

** Maintaining operations, printing banknotes and making coins include: expenditures on employees, wages and salaries, social and medical insurance, printing banknotes and making coins, expenditures from property transfers, non-receivable loans from clients, and other maintenance expenditures.

*** Creating Reserves for Deposits include: legal reserves and insurance for classified loans, reserves for financial papers (as described above), reserves for tangible and non-tangible property, reserves for loans, reserves for given insurance, other reserves.

Tables similar to *Table A1* and *Table A2* for the period 1993-1996 were used to obtain the data presented in *Table A3*.

Table A3.

Data used for the computation of the total gross seigniorage
and its main components (nominal values)

<i>Year</i>	P_t	$C^{Co\&BN}$	C^{CB}	G	$R^G - i^G A^G$	A^G	A^F	$IR-IE$	e	DM
1993	100.0	0.696	0.08	-1.785	1.509	9,56	13.71	7.9	17.64	16,7
1994	109.6	0.502	0.17	2.053	1.438	-24,88	60.73	8.69	17.75	44
1995	118.3	0.317	0.13	5.386	1.002	-37,89	158.8	8.36	18.52	42,06
1996	128.5	0.285	0.60	-4.806	-8.654	-43,1	164.3	3.62	18.06	58,83
1997	141.4	0.366	5.40	40.162	10.745	-34,14	122.5	6.84	18.28	-6,12

where

P_t – the general price level (reported annually by the Czech Statistical Office);

$C^{Co\&BN}$ – costs incurred by the Czech National Bank for printing bank notes and minting coins, $C^{Coin} + C^{BN}$ (in billions of Czech Crowns);

C^{CB} – costs for maintaining operations (in billions of Czech Crowns);

G – revenue from central bank's operations (in billions of Czech Crowns),

$R^G - i^G A^G$ – net profit distributed to the government (in billions of Czech Crowns);

A^G – government debt (in billions of Czech Crowns),

A^F – foreign debt held by the Czech National Bank, respectively (in billions of Czech Crowns);

$IR-IE$ – net interest revenues of the Czech National Bank (in billions of Czech Crowns);

e – the exchange rate of the Czech currency with respect to the German Mark, (expressed as units of Czech Crowns per one German Mark).

DM — change in the monetary base (in billions of Czech Crowns).

Sources:

$C^{Co\&BN}$ (cost of printing banknotes and making coins) is presented in the Profit and Loss Statement of the Czech National Bank (see Table A2, item E2.1).

C^{CB} (costs of maintaining operations) is presented in the Profit and Loss Statement of the Czech National Bank (see Table A2, item E2.2).

G (revenue from the central bank's operations) presented in the Profit and Loss Statement of the Czech National Bank (see Table A2, items $R2+R3$).

$R^G - i^G A^G$ (net profit distributed from the central bank to the government) is reported in the Profit and Loss Statement of the Czech National Bank (see Table A2, item $R4$).

A^G (government debt held by the Czech National Bank) is determined base on internal data of the Czech National Bank (negative values, and negative changes, reflecting large government income from privatization).

A^F (foreign debt held by the Czech National Bank) is determined as the difference between *International Reserves* (Table A1, items $A.1.2+A.1.3+A.2.1$) and *Foreign Deposits* (Table A1, item $L.2$).

$IR-IE$ (net interest revenues of the Czech National Bank) determined as the difference between *Interest Revenues* (Table A2, item $R.1$) and *Interest Expenditures* (Table A2, item $E.1$).

e (the exchange rate of the Czech currency with respect to the German Mark) is reported by the Czech National Bank.

DM (change in the monetary base) reported by the Czech National Bank.

References

- Budina, N. (1997) Essays on Consistency of Fiscal and Monetary Policy in Eastern Europe. Tinbergen Institute Research Series 145, University of Amsterdam.
- Bruni, F., Penati, A. and Porta, A. (1989) Financial regulation, implicit taxes, and fiscal adjustment in Italy. In M.Monti (ed.), *Fiscal Policy, Economic Adjustment, and Financial Markets*, IMF Publication Service, Washington, D.C.
- Cukrowski, J. and Janecki, J. (1998) Financing Budget Deficits by Seigniorage: the Case of Poland 1990-1997. *Studies and Analyses* No. 155, Center for Social and Economic Analyses (CASE), Warsaw 1998, pp. 30.
- Drazen, A. (1985) A general measure of inflation tax revenues. *Economic Letters*, 17, 327-330.
- Drazen, A. (1989) Capital controls and seignorage in an open economy. In M. de Cecco and A. Giovannini (eds.), *A European Central Bank? Perspectives on Monetary Unification After Ten Years of the EMS*, Cambridge University Press, Cambridge.
- Hochreinter, E., Rovelli, R. and Winckler, G. (1996) Central banks and seigniorage: a study of three economies in transition. *European Economic Review (Papers and Proceedings)*, 40, 629-643.
- Grilli, V. (1989) Seignorage in Europe. In M. de Cecco and A. Giovannini (eds.), *A European Central Bank? Perspectives on Monetary Unification After Ten Years of the EMS*, Cambridge University Press, Cambridge.
- Gross, D. (1993) Seignorage and EMU. *European Journal of Political Economy*, 9, 581-601.
- Horrendorf, B. (1997) Time consistent collection of optimal seignorage: a unifying framework. *Journal of Economic Surveys*, 11:1, 1-41.

- Klein, M. and Neumann, M.J.M. (1990) Seignorage: what is it and who gets it?
Weltwirtschaftliches Archiv, 126, 205-221.
- Kotulan, A. (1995) Razebné a fiskální razebné: problémy merení. Česká Národní Banka,
Institut Ekonomie 44, Praha.
- Neumann M.J.M. (1996) A Comparative Study of Seignorage: Japan and Germany.
Bank of Japan Monetary and Economic Studies, 14:1, 104-142.
- Oblath, G. and Valentinyi, A. (1994) Seignorage and Inflation tax: some theory and an
application to Hungary. Working paper, KOPINT-DATORG, Budapest.